WE CLAIM:

1. A gadolinium-containing metal alloy for neutron absorption comprising:

a) gadolinium at from about 0.1% to 10% by weight;

b) from about 13% to 18.5% by weight;

c) molybdenum at from about 1.5% to 16% by weight;

d) manganese at from residual amounts to about 3% by weight;

e) nickel at from about 10% to 85% by weight;

f) residual amounts of phosphorus, sulfur, silicon, carbon, and nitrogen;

g) a ferrite content of less than 5% by weight; and

h) a balance of material substantially comprising iron, and wherein the alloy is formulated to prevent liquidation of gadolinium-containing compounds and cracking at temperatures from about 800°C to 1200°C.

2. A gadolinium-containing metal alloy as in claim 1 wherein the nickel is present at from about 50% to 85% by weight.

3. A gadolinium-containing metal alloy as in claim 1 wherein the nickel is present at from about 10% to 23% by weight.

4. A wrought austenitic stainless steel alloy comprising:

a) gadolinium at from about 0.1% to 4% by weight;

b) from about 13% to 18.5% by weight;

c) molybdenum at from about 1.5% to 4% by weight;

d) manganese at from about 1% to 3% by weight;

e) nickel at from about 10% to 23% by weight;

f) residual amounts of phosphorus, sulfur, silicon, carbon, and nitrogen; and

g) a balance of material substantially comprising iron, wherein the ferrite content of the alloy is less than 5% by weight, and wherein the hot forming range is within from about 800°C to 1000°C.

5. A stainless steel alloy as in claim 4 wherein the gadolinium is present at from 0.1% to 2% by weight; the chromium is present at from 14% to 18% by weight; the molybdenum is present at from about 1.5% to 3% by weight; and the manganese is present at from about 1% to 2% by weight.

6. A stainless steel alloy as in claim 5 wherein the stainless steel alloy is formulated for manufacture using conventional stainless steel ingot casting technology.

7. A stainless steel alloy as in claim 5 wherein the nickel content is from about 11% to 15% by weight.

8. A stainless steel alloy as in claim 7 wherein the gadolinium is present at from 0.1% to 1.2% by weight.

9. A stainless steel alloy as in claim 4 wherein the stainless steel alloy is configured as an internal.

10. A stainless steel allow as in claim 4 wherein the stainless steel alloy is configured as a canister.

11. A spent nuclear fuel storage system configured for thermal neutron absorption and corrosion resistance comprising a poisoned member, said poisoned member being substantially comprised of a cast austenitic stainless steel alloy, said alloy comprising:

a) gadolinium at from about 0.1% to 4% by weight;

b) chromium at from about 13% to 25% by weight;

c) molybdenum at from about 1.5% to 4% by weight;

d) manganese at from about 1% to 3% by weight;

e) nickel at from about 10% to 25% by weight;

f) residual amounts of phosphorus, sulfur, silicon, carbon, and nitrogen; and

g) a balance of material substantially comprising iron,and wherein the a ferrite content is from 2% to 25% by weight.

12. A system as in claim 11 wherein the poisoned member is an internal.

13. A system as in claim 11 wherein the poisoned member is a canister.

14. A system as in claim 11 further comprising a second poisoned member having the composition described from a) to g), and wherein the poisoned member is an internal and the second poisoned member is a canister.

15. A wrought nickel-based alloy comprising:

a) gadolinium at from about 0.1% to 10% by weight;

b) from about 13% to 24% by weight;

c) molybdenum at from about 1.5% to 16% by weight;

d) iron at from about 0.01% to 6% by weight;

e) residual amounts of manganese, phosphorus, sulfur, silicon, carbon, and nitrogen; and

f) a balance of material substantially comprising nickel wherein the nickel is present at greater than 50% by weight and the hot forming range is from about 800°C to 1200°C.

16. A nickel-based alloy as in claim 15 wherein the iron is present at from about 0.01% to 3% by weight.

17. A nickel-based alloy as in claim 15 wherein the chromium is present at from 20% to 24% by weight, and the molybdenum is present at from about 14% to 16% by weight.

18. A nickel-based alloy as in claim 15 wherein the gadolinium is present at from about 0.1% to 3% by weight.

19. A nickel-based alloy as in claim 15 wherein the nickel-based alloy is configured as an internal.

20. A nickel-based alloy as in claim 15 wherein the nickel-based alloy is configured as a canister.

21. A cast nickel-based alloy comprising:

a) gadolinium at from about 0.1% to 10% by weight;

b) chromium at from about 13% to 24% by weight;

c) molybdenum at from about 1.5% to 16% by weight;

d) iron at from about 0.01 to 6% by weight;

e) residual amounts of manganese, phosphorus, sulfur, silicon, carbon, and nitrogen; and

f) a balance of material substantially comprising nickel wherein the nickel is present at greater than 50% by weight.

22. A nickel-based alloy as in claim 21 wherein the iron is present at 0.01 to 3% by weight.

23. A nickel-based alloy as in claim 21 wherein the chromium is present at from 20% to 24% by weight, and the molybdenum is present at from about 14% to 16% by weight.

24. A nickel-based alloy as in claim 21 wherein the gadolinium is present at from about 0.1% to 3% by weight.

25. A nickel-based alloy as in claim 21 wherein the nickel-based alloy is configured as an internal.

26. A nickel-based alloy as in claim 21 wherein the nickel-based alloy is configured as a canister.